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ABSTRACT

This document presents supporting material for the argument that performance based (competency based) teacher education (PBTE) is more cost-effective, and rated higher by participating students, than a non-performance based teacher education program. The paper compares the System for Individually Guided Mastery Attainment (SIGMA) and traditional Subject Centered Teacher Education (SCTE) program of San Diego State University. Student attitudes were investigated by a number of questionnaires and measuring scales, and revealed that: (1) the program met learning needs of most of the students; (2) materials were presented in a clear, logical, and interesting manner, focusing on and applying basic principles of teaching/learning; (3) the majority of students and cooperating teachers viewed the program as developing relevant skills; and (4) skill attainment was fairly and adequately assessed. In a conservative cost analysis, in which most of the burden was placed on the SIGMA approach, it was concluded that the SIGMA program was at least \$1,044 per student teacher more cost-effective than the SCTE program. (HJB)

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CBTE:

IS IT WORTH THE EFFORT?

A Paper
Assembled For The
California State Commission
For
Teacher Preparation And Licensing

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Introduction

The teacher of today needs to possess a wide range of teaching skills that will assist each child to develop his potentialities and to become the best human being he can - one who is fully integrated and fully functioning. The teacher should be well prepared in the content to be taught, should be skilled in the flexible management of the learning environment, and should have a well developed repertory of interpersonal skills through which effective interaction in the classroom can occur.

In response to the need to explore some alternative paths for granting a teaching credential, as well as more closely integrating the development of teaching behaviors in a teacher education program, an individualized, competency-based teacher education program was developed at San Diego State University. Cognizant of the concerns regarding competency-based education, the faculty involved sought to develop a model that would minimize the impact of some of the stated concerns through the use of monitoring and formative evaluation procedures.

The program, System for Individually Guiding Mastery Attainment (SIGMA), was developed as a two-semester (31 unit) program departing from the structure and organization of other programs offered in the Elementary Education Department in a number of ways.

The content emphasis was not identified as course work, but flow-charted into a skills development program intended to develop generic teaching skills transferable to all settings (see Figures 1 and 2). The selection and sequencing of these skills require that the content be highly integrated,

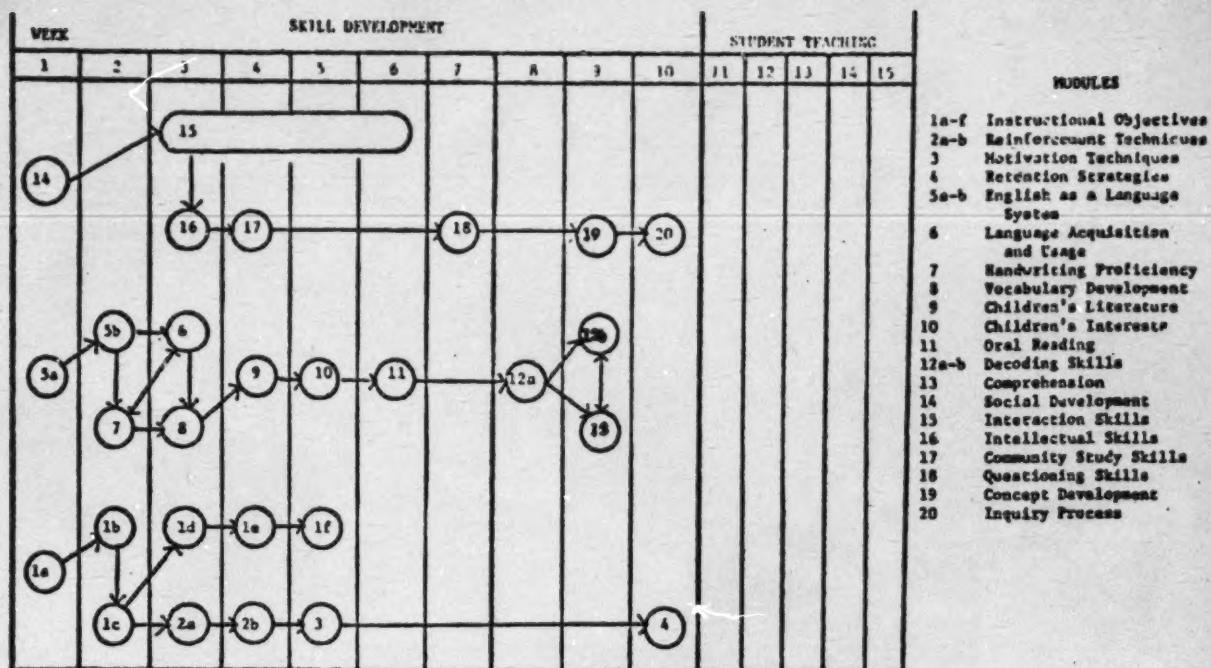


Figure 1

FLOW CHART FOR SKILL DEVELOPMENT AND STUDENT TEACHING - FIRST SEMESTER (FIFTEEN WEEKS)

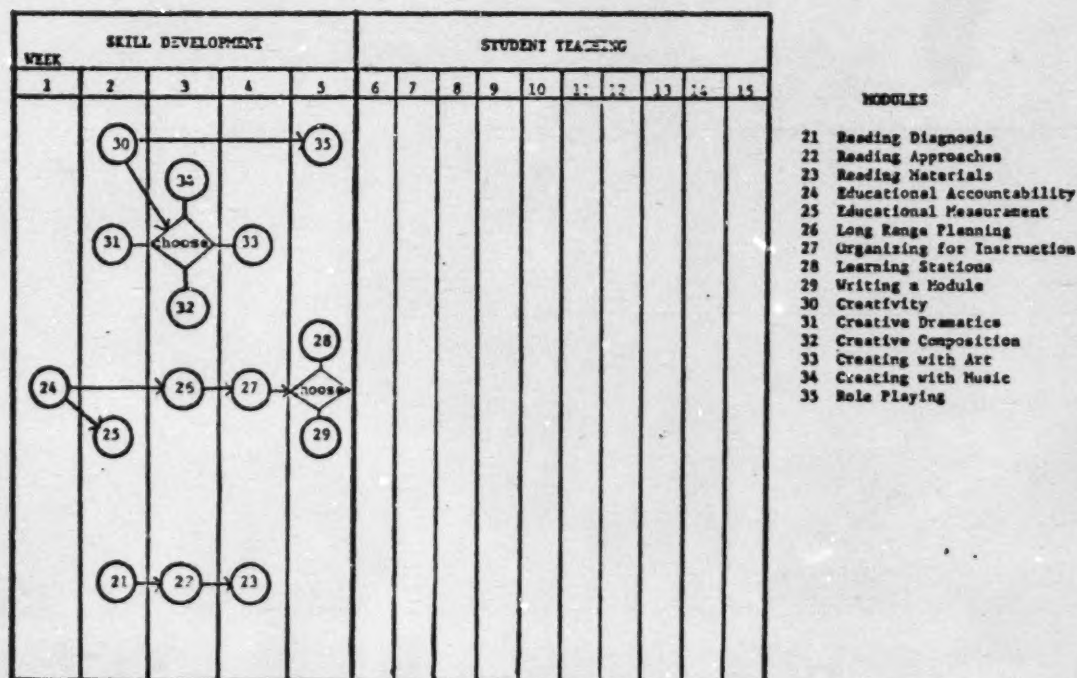


Figure 2

FLOW CHART FOR SKILL DEVELOPMENT AND STUDENT TEACHING - SECOND SEMESTER (15 WEEKS)

not only horizontally, but vertically between skill strands to establish prerequisites and intra-relationships.

Evaluation procedures incorporated criterion-referenced testing based on behaviorally stated objectives, stressed attainment of a level of mastery, and provided for remediation in order to reach that level. In grading practices, the instructors used the letter grade A as an indicator of mastery and Incomplete to give the student an extended time for finishing the strand.

Organizational structures chosen to deliver the model involved the development of a campus based learning center and field-based laboratory. Modules (learning packages) were used to individualize the program so that students could move through the skill development strands at their own paces. Campus facilities were provided in the form of an Individualized Study Center to support the model with print, audio, and video media. A time sequence which moved the student gradually into the classroom allowed for a block of time to develop specified teaching skills and a block of time for full-time student teaching which, in total, was the equivalent of one semester (see Figures 1 and 2, again).

The content and organizational changes necessitated changes in the roles of the participants. The students were required to assume more responsibility for their learning; the university instructor was relieved of much of the task of information delivery and became more of a manager, counselor, and facilitator; the cooperating classroom teacher became pivotal in providing classroom experiences that helped the students bridge from theory to practice.

During the developmental stages (1971-1974), and during the first year of the implementation of SIGMA as a full-year credential program (1974-1975), the university team monitored student progress and attitude for both internal review and revision, and for external assessment of competency-based education as a viable model for teacher training. Also, during the first year of implementation of SIGMA, a cost-effectiveness analysis comparing the SIGMA program to the regular non-competency-based program was conducted.

Student Attitudes Toward SIGMA

Formative evaluation procedures were instituted during the first year of SIGMA in an effort to ascertain whether a competency-based teacher education program could be developed that (1) functioned as a viable alternative to a traditional teacher-education program, (2) specified and evaluated teaching skills relevant to the practical classroom situation, (3) maintained effective instructor-student contact and feedback, and (4) utilized a criterion-referenced grading procedure that would not dilute the quality of the education of the participating students.

The students were not selected especially for the competency-based program, but enrolled on the basis of the registration procedure utilized by the School of Education. Originally, thirty-four students were assigned to the block, but one student was counseled out of the program and one student dropped for personal reasons. Data was collected at the end of the first semester from thirty-three students and at the end of the second semester from thirty-two students and nineteen cooperating teachers.

Strong trends in the data were observed both semesters when students reacted to thirteen items on the semantic differential. Modal responses

indicate students saw this model of competency-based teacher education as "interesting" rather than "dull", "humanistic" rather than "mechanistic", "good" rather than "bad", "relevant" rather than "trivial", "flexible" rather than "rigid", "demanding" rather than "Mickey Mouse", required "mastery" as opposed to "shuffling through", "definite" rather than "indefinite", "valuable" rather than "valueless", "personal" rather than "impersonal", "pleasant" rather than "unpleasant", and "original" rather than "unimaginative". This data parallels original studies conducted with the developmental program. Chi-square procedures showed that the opinions were stable; however, by the end of spring semester, a significant improvement was found in two of the thirteen areas, Personal and Satisfying.

On a three-point Thurstone scale all of the following aspects of the program were rated "Very Valuable" as opposed to "Somewhat Valuable" or "Not Valuable": individualized, testing based on objectives, grading, developing skills rather than knowledge, availability of pre-assessment, use of remediation rather than a low mark, emphasis on mastery learning, integration of course work and student teaching, and emphasis on classroom performance. Statistical investigation revealed a significant increase in students' perceptions of the value of the individualized aspect of the program in the second semester.

The students rated items on a five-point Likert scale concerning the degree of agreement with statements pertaining to the model of competency-based education. Student opinion strongly supported all of these features. No significant differences were observed between responses from first and second semesters.

Additional responses included on the questionnaire used during spring semester investigated grading practices, interaction and use of modules. These ratings show agreement with the grading practices in SIGMA and positive reactions to modules as teaching-learning devices. Ambivalent reactions were revealed by the bi-modal responses dealing with the interaction aspect of the program.

In order to investigate the relevancy of the skills development program, students also rated the content of the module sequence on a three-point Thurstone scale: "Very Relevant", "Somewhat Relevant", "Not Relevant". The modal responses indicate that a majority of the students perceived sixteen of the twenty modules in the fall semester as highly relevant. The relevancy of the skills developed during the first semester was maintained. The only significant difference was found as skills in reinforcement became more highly relevant the second semester. The same pattern occurred the second semester where thirteen of the fifteen modules were rated as very relevant.

Cooperating classroom teachers were also asked to rate the relevancy of the skill development program. Modal responses indicate that these teachers perceived thirty-one of the thirty-five modules to be very relevant.

Comparisons between student and cooperating teachers revealed some perceived differences in the relevancy of the content. Students saw Creating with Music as more relevant, while cooperating teachers saw Vocabulary and Handwriting Proficiency, Writing a Module as more relevant.

Discussion of Data on Student Attitudes

From the foregoing analysis it seems reasonable that one can conclude that this model of teacher training (SIGMA) has certain features that make it a viable alternative to traditional teacher education programs. The attitudes reflected in the modal responses on the semantic differential support the contention of proponents of competency-based teacher education, that such an individualized, modularized, performance-based program can meet the learning needs of most students. This conclusion is further supported by the high value students placed on the special features of the program. In fact, the individualized aspect of the program was significantly more valuable as the students continued. It is interesting to note that the program was likewise more satisfying for more students during the second semester.

Student reactions to modules (learning packages) tend to refute criticisms that view this vehicle as overly programmed and mechanistic. On the contrary, a majority of students in SIGMA view this program approach as presenting material in a clear, logical and interesting manner as well as focusing on and applying basic principles of teaching-learning. The only degree of student criticism is reflected in the amount of time needed to complete the modules.

Responses on questionnaire items of relevancy support a conclusion that a majority of students and cooperating teachers view the skill development program as developing relevant skills needed by a classroom teacher. These perceptions are further validated by the large number of students who indicated that they had been helped to apply basic principles

of teaching and learning in the classroom. Most of the students felt that their skills were fairly and adequately assessed and their perceptions of performance indicated support for the conclusion that they felt they had reached high levels of competency.

Any discrepancies in the reactions were used as possible indicators for review and revision. Program modification and improvement, based on such formative data, suggest that competency-based programs need not be static - but can and should be regenerative.

A Comparative Cost-Effectiveness Analysis

The following is a synthesis of research findings, conclusions, and implications for teacher training derived from the study titled A Cost-Effectiveness Analysis of Competency-Based and Non-Competency-Based Teacher Education at San Diego State University.

The study was accomplished during the first year of SIGMA and involved the samples shown in Table I.

It was not possible to randomly assign student teachers to the two programs. However, as noted earlier, students were not selected especially for the competency-based program. All were enrolled on the basis of the regular registration procedure used by the Department of Elementary Education. Additionally, no significant differences were found when initial interview ratings, GPA, or numbers of men and women were compared for the two programs. It should also be noted that students were observed to be more reluctant to enter the SIGMA program since it was an unknown and, in fact, the SIGMA block was the last to fill at registration.

Table I

Samples for the Cost-Effectiveness Study

	SIGMA	Regular Program	TOTAL
Student Teachers	33	40	73
Professors	3	12	15
University Supervisors	3	5	8
School Children	2,019	2,248	4,267

Teaching Effectiveness

Four observational instruments were utilized to evaluate the teaching effectiveness of student teachers in both the SIGMA and Subject-Centered Teacher Education (SCTE) Programs. These instruments were as follows:

1. Student Knowledge Assessment of Teacher Education (SKATE). This is a test developed by Dr. Donald Enos from the approved program objectives contained in the Department of Elementary Education Ryan proposal (Appendix A).
2. Reciprocal Category System for verbal interaction analysis developed by Richard Ober (Appendix B). This system was used to code verbal interaction into the following five categories:
 - a. Warm/Cool Ratio
 - b. Acceptance/Correction Ratio
 - c. Elicit/Initiate Ratio
 - d. Children/Student-Teacher Ratio
 - e. Acceptance/Rejection Ratio
3. Descriptive Observational Record for Individualization of Instruction (DORII) by Ben Harris and Ken McIntyre (Appendix C) and the Individualization of Instruction Inventory (III) by Betty Coody and Ben Harris (Appendix D). These instruments grouped data into the following factors:
 - a. Intra-Class Grouping
 - b. Variety of Materials
 - c. Pupil Autonomy
 - d. Differentiated Assignments
 - e. Tutoring

4. Student Evaluation of Teacher Instrument II (SETII) by Ruth Haak, Douglas Kleiber and Robert Pect (Appendix E). Children's attitudes toward their student teacher were sampled for each of the following factors:
 - a. Interactional Competence
 - b. Rapport
 - c. Stimulating, Interactive Style
 - d. Unreasonable Negativity
 - e. Fostering of Self-Esteem

In addition to collecting the data on teaching effectiveness, cost data was assembled in order to ascertain whether or not there was a difference in the absolute costs of one program over the other and also to determine whether or not one program was more cost-effective than the other.

Data were analyzed using t-tests and chi-squares to look for significant differences between the two programs. The significance level adopted for the study was the .05 level of probability or better.

A significant difference favoring SIGMA was found between the two groups on the SKATE at the .001 level for both the fall and spring semesters. A significant difference at the .001 level was also found on the composite analysis for the 1974-1975 academic year (see Table II).

The student teachers of the competency-based teacher education program were able to demonstrate significantly greater attainment of specific knowledge learned from formal course work based on the Student Knowledge Assessment of Teacher Education instrument. The differences noted were:

1. The SIGMA program utilizing competency-based modules for teaching preparation appeared to produce more learning.

Table II
Results for
Student Knowledge Assessment of Teacher Education
(SKATE)

Semester	SIGMA		SCTE		df	t
	MEAN	SD	MEAN	SD		
Fall	11.91	2.01	5.50	2.72	71	11.25*
Spring	10.33	2.99	6.95	4.41	71	3.52*
Year	22.24	3.88	12.85	5.37	71	11.89*

*
Significant at $p < .001$

2. The SIGMA program provided for a more satisfactory development of knowledge as defined by the specific objectives proposed by the Department of Elementary Education at San Diego State University.
3. The SIGMA program appeared to best reach the criteria approved by the California Commission for Teacher Preparation and Licensing.

A significant difference was found between the two groups for each of the five ratios calculated for verbal interaction as measured by the Reciprocal Category System (see Table III).

The student teachers of the SIGMA program were able to demonstrate significantly better verbal interaction with children than were student teachers in the SCTE program. The differences noted were as follows:

1. The ability to provide for and personally utilize more positive reinforcement and the elimination of tension within the classroom.
2. The ability to provide a more accepting classroom atmosphere and to facilitate the development of more positive feeling within the children.
3. The ability to provide increased opportunities for children to present unsolicited facts, information, and opinions during the instructional process.
4. The ability to facilitate the children's interactions within the classroom.

Significant differences at the .001 level were found for individualization of instruction in all but the categories of Intra-Class Grouping and Variety of Materials for the fall semester, 1974 (see Table IV).

The SIGMA program provided an increased number of training techniques for the student teachers in individualizing instruction within the classroom.

Table III
 LEVELS OF SIGNIFICANT DIFFERENCES
 FOUND FOR VERBAL INTERACTION
 MEASURED BY THE RECIPROCAL CATEGORY SYSTEM (RCS)

RATIO	MEASUREMENT PERIOD	SIGMA	SCTE	NSD
Warm/Cool	Fall '74	.05		
	Spring '75	.001		
	Year 74-75	.001		
	Follow-up '75	.001		
Accept/Correct	Fall '74	.001		
	Spring '75	.001		
	Year 74-75	.001		
	Follow-up '75	.001		
Elicit/Initiate	Fall '74			X
	Spring '75	.001		
	Year 74-75	.001		
	Follow-up '75			X
Children/Student- Teacher Talk	Fall '74	.001		
	Spring '75	.001		
	Year 74-75	.001		
	Follow-up '75			X
Acceptance/ Rejection	Fall '74	.001		
	Spring '75	.001		
	Year 74-75	.001		
	Follow-up '75	.001		

Table IV

LEVELS OF SIGNIFICANT DIFFERENCES FOUND FOR
INDIVIDUALIZATION OF INSTRUCTION AS MEASURED BY THE
DESCRIPTION OBSERVATIONAL RECORD FOR INDIVIDUALIZATION
OF INSTRUCTION AND THE INDIVIDUALIZATION OF INSTRUCTION
INVENTORY

CATEGORY	SEMESTER	CBTE	SCTE	NSD
Intra-Class Grouping	Fall			X
	Spring	.001		
	Year	.001		
	Follow-up	.001		
Variety of Materials	Fall			X
	Spring	.001		
	Year	.001		
	Follow-up	.001		
Pupil Autonomy	Fall	.001		
	Spring	.001		
	Year	.001		
	Follow-up	.001		
Differentiated Assignments	Fall	.001		
	Spring	.001		
	Year	.001		
	Follow-up	.001		
Tutoring	Fall	.001		
	Spring	.001		
	Year	.001		
	Follow-up	.001		
Total Individualization of Instruction	Fall	.001		
	Spring	.001		
	Year	.001		
	Follow-up	.001		

Table V
LEVELS OF SIGNIFICANT DIFFERENCES FOUND FOR
CHILDREN'S PERCEPTIONS OF TEACHER PERFORMANCE
AS MEASURED BY THE
STUDENT EVALUATION OF TEACHING INSTRUMENT

FACTOR	SEMESTER	GRADE	CBTE	SCTE	NSD	NM
Stimulating, Interactive Style	Fall	K			X	
	Spring	K	.01			
	Year	K	.05			
	Follow-Up	K				X
	Fall	1-3			X	
	Spring	1-3	.001			
	Year	1-3	.001			
	Follow-Up	1-3	.001			
Rapport	Fall	4-6			X	
	Spring	4-6	.001			
	Year	4-6	.001			
	Follow-Up	4-6	.001			
Interactional Competence	Fall	4-6			X	
	Spring	4-6	.001			
	Year	4-6	.001			
	Follow-Up	4-6	.001			
Unreasonable Negativity	Fall	K			X	
	Spring	K			X	
	Year	K			X	
	Follow-Up	K				X
	Fall	1-3		.001		
	Spring	1-3	.001			
	Year	1-3	.001			
	Follow-Up	1-3	.001			
	Fall	4-6			X	
	Spring	4-6	.001			
	Year	4-6	.001			
	Follow-Up	4-6	.01			
Fosterance of Self-Esteem	Fall	K			X	
	Spring	K			X	
	Year	K			X	
	Follow-Up	K				X
	Fall	1-3			X	
	Spring	1-3	.001			
	Year	1-3	.001			
	Follow-Up	1-3	.001			
	Fall	4-6			X	
	Spring	4-6	.001			
	Year	4-6	.001			
	Follow-Up	4-6	.01			

The SIGMA program student teachers provided more flexibility and task-oriented situations for children; a wider variety and availability of materials throughout the classroom; and greater pupil participation in planning, self-direction, leadership in groups, and individual activities. The SIGMA program student teachers also provided greater challenges in children's assignments, as well as relationship of the assignments to diagnosed learning needs, and tutoring of individuals with learning problems.

Student teacher performance was rated using the Student Evaluation of Teacher Instrument. For the spring semester and the composite analysis for the 1974-1975 academic year, significant differences were consistently found favoring the SIGMA program except for the kindergarten classes (see Table V).

Only one significant difference in favor of the SCTE program was found ("Unreasonable Negativity", fall semester, grades 1-3). Subsequent analysis reversed that finding in the spring semester, 1975, and again in the follow-up study during the fall semester 1975. These analyses indicated that the SIGMA program provided better opportunities for the student teachers to be understood by the children in the classroom.

When examining Table V the null hypothesis must be accepted for the fall semester because there is a consistent pattern of no significant differences in children's ratings of student teacher performance. However, during the measurement periods of spring and fall, 1975, significant differences in ratings by the children were observed favoring the SIGMA program student teachers in the areas of stimulating, interactive style rapport, interactional competence, unreasonable negativity, and the fosterance of self-esteem.

Cost-Effectiveness

For comparison purposes, the costs for the SCTE program were set at zero because of the non-availability of absolute cost data dating back to the time when that program was originally established (about 1900). Thus the analysis is quite conservative and places most of the burden on the SIGMA program. The absolute costs of the SIGMA program were \$425,525 for the research and development, implementation, and annual operating phases.

The added teaching effectiveness benefits for SIGMA students which were just described in the preceding section were each given an estimated dollar value and were determined to be worth \$15,971 per student teacher. The actual costs per student teacher in the SIGMA program were \$4,877 including a large "one time" tool-up cost of \$1,512. As a result, the cost-effectiveness was determined by the difference between costs and benefits, or \$11,044 per student teacher. This figure includes a \$10,000 lost opportunity cost against those in the SCTE program which the reader may not wish to include. If this is removed an even more conservative figure of \$1,044 per student teacher of cost-effectiveness favoring SIGMA is obtained.

In the most conservative sense, then, it is concluded that the SIGMA program is at least \$1,044 per student teacher more cost-effective than the SCTE program.

Conclusions

The data generated by these studies indicates that a CBTE training program can constitute a significant improvement over traditional programs of teacher education. The innovative SIGMA program was worth the dollar

cost as well as the considerable effort involved. Cost data was presented for interested administrators and policy makers to utilize when considering the acceptance or rejection of the competency-based model as a viable approach to teacher training. The program provided an additional \$5,097 to \$15,097 in benefits (teaching effectiveness skills) for each student who was matriculated. This finding implies that future competency-based teacher education programs can provide an answer for increasing the quality of pre-service training.

The question now becomes: Should competency-based teacher education be supported, or should existing teacher training programs become competency-based? The evaluation of CBTE training programs is still in its early stages of development and faces many problems; however, if this first effort is an accurate indicator, it seems clear that competency-based teacher education is well worth the effort.

Note: Copies of Appendix A, B, C, D, or E are not attached because of their length, however, copies will be supplied upon request.